

Applicants : Robert L. Bingle, Joseph Camilleri, Peter J. Whitehead and Kenneth Schofield
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Amendments to the Specification:

Please amend the paragraph beginning at page 12, line 30 as follows:

Camera module 10 provides a camera or image capture device 18 for capturing an image of a scene occurring exteriorly or interiorly of a vehicle. The captured image may be communicated to a display or display system 9a which is operable to display the image to a driver of the vehicle. The camera or imaging sensor 18 useful with the present invention may comprise an imaging array sensor, such as a CMOS sensor or a CCD sensor or the like, such as disclosed in commonly assigned U.S. Pat. Nos. 5,550,677; 5,670,935; 5,796,094; and 6,097,023, and U.S. pat. application, Ser. No. 09/441,341, filed Nov. 16, 1999 by Schofield et al. for VEHICLE HEADLIGHT CONTROL USING IMAGING SENSOR, now U.S. Pat. No. 7,339,149 (Attorney Docket DON01 P 770), which are hereby incorporated herein by reference. Camera module 10 and imaging sensor 18 may be implemented and operated in connection with various vehicular vision systems, and/or may be operable utilizing the principles of such other vehicular systems, such as a vehicle headlamp control system, such as the type disclosed in U.S. Pat. Nos. 5,796,094; 6,097,023; 6,320,176; and 6,559,435, and U.S. pat. applications, Ser. No. 09/441,341, filed Nov. 16, 1999 by Schofield et al. for VEHICLE HEADLIGHT CONTROL USING IMAGING SENSOR, now U.S. Pat. No. 7,339,149 (Attorney Docket DON01 P 770); and Ser. No. 10/427,146, filed Apr. 30, 2003 by Schofield et al. for VEHICLE HEADLIGHT CONTROL USING IMAGING SENSOR, now U.S. Pat. No. 6,831,261 (Attorney Docket DON01 P 1091), which are all hereby incorporated herein by reference, a rain sensor, such as the types disclosed in commonly assigned U.S. Pat. Nos. 6,353,392; 6,313,454; and/or 6,320,176, which are hereby incorporated herein by reference, a vehicle vision system, such as a forwardly, sidewardly or rearwardly directed vehicle vision system utilizing principles disclosed in U.S. Pat. Nos. 5,550,677; 5,670,935; 5,760,962; 5,877,897; 5,949,331; 6,222,447; 6,302,545; 6,396,397; 6,498,620; 6,523,964; 6,611,202; and 6,201,642, and/or in U.S. pat. applications, Ser. No. 09/199,907, filed Nov. 25, 1998 by Bos et al. for WIDE ANGLE IMAGE CAPTURE SYSTEM

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FOR VEHICLE, now U.S. Pat. No. 6,717,610 (Attorney Docket ~~DON01 P-676~~); Ser. No. 10/372,873, filed Feb. 24, 2003 by Schofield et al. for VEHICLE IMAGE CAPTURE SYSTEM, now U.S. Pat. No. 6,802,617 (Attorney Docket ~~DON01 P-1077~~); Ser. No. 10/011,517, filed Nov. 5, 2001 by Bos et al. for INTERIOR REARVIEW MIRROR SYSTEM INCLUDING A FORWARD FACING VIDEO DEVICE, now U.S. Pat. No. 6,806,452 (Attorney Docket ~~DON01 P-934~~); Ser. No. 10/324,679, filed Dec. 20, 2002 by Schofield et al. for VEHICULAR VISION SYSTEM, now U.S. Pat. No. 6,891,563 (Attorney Docket ~~DON01 P-1059~~); Ser. No. 10/047,901, filed Jan. 14, 2002 by Bos et al. for VEHICLE IMAGING SYSTEM WITH ACCESSORY CONTROL, now U.S. Pat. No. 6,822,563 (Attorney Docket ~~DON08 P-949~~); Ser. No. 10/643,602, filed Aug. 19, 2003 by Schofield et al. for VISION SYSTEM FOR A VEHICLE INCLUDING IMAGING PROCESSOR (Attorney Docket DON01 P-1087); and Ser. No. 10/010,862, filed Dec. 6, 2001 by Bos for PLASTIC LENS SYSTEM FOR VEHICLE IMAGING SYSTEM, now U.S. Pat. No. 6,757,109 (Attorney Docket ~~DON01 P-954~~), which are all hereby incorporated herein by reference, a trailer hitching aid or tow check system, such as the type disclosed in U.S. pat. application, Ser. No. 10/418,486, filed Apr. 18, 2003 by McMahon et al. for VEHICLE IMAGING SYSTEM, now U.S. Pat. No. 7,005,974 (Attorney Docket ~~DON01 P-1070~~), which is hereby incorporated herein by reference, a reverse or sideward imaging system, such as for a lane change assistance system or lane departure warning system, such as the type disclosed in U.S. pat. application, Ser. No. 10/427,051, filed Apr. 30, 2003 by Pawlicki et al. for OBJECT DETECTION SYSTEM FOR VEHICLE, now U.S. Pat. No. 7,038,577 (Attorney Docket ~~DON01 P-1075~~), which is hereby incorporated herein by reference, a traffic sign recognition system, a system for determining a distance to a leading or trailing vehicle or object, such as a system utilizing the principles disclosed in U.S. Pat. No. 6,396,397, which is hereby incorporated herein by reference, and/or the like.

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Please amend the paragraph beginning at page 15, line 1 as follows:

Although shown at a rear portion of a vehicle, camera 18 and camera module 10 may be positioned at any suitable location on the vehicle, such as within a rear panel or portion of the vehicle, a side panel or portion of the vehicle, a license plate mounting area of the vehicle, an exterior mirror assembly of the vehicle, an interior rearview mirror assembly of the vehicle or any other location where the camera may be positioned and oriented to provide the desired view of the scene occurring exteriorly or interiorly of the vehicle. The camera module of the present invention is particularly suited for use as an exterior camera module. However, the camera module may be positioned at an interior portion of the vehicle, such as at or in an interior rearview mirror assembly or accessory module at or near an interior rearview mirror assembly, to provide an image of an interior scene or of an exterior scene through a window or windshield of the vehicle, without affecting the scope of the present invention. The image captured by the camera may be displayed at a display screen or the like positioned within the cabin of the vehicle, such as at an interior rearview mirror assembly (such as disclosed in U.S. pat. application, Ser. No. 09/793,002, filed Feb. 26, 2001 by Schofield et al. for VIDEO MIRROR SYSTEMS INCORPORATING AN ACCESSORY MODULE, now U.S. Pat. No. 6,690,268 (Attorney Docket DON01 P-869), which is hereby incorporated herein by reference), or elsewhere at or within the vehicle cabin, such as by using the principles disclosed in U.S. Pat. Nos. 5,550,677; 5,670,935; 5,796,094; 6,097,023 and 6,201,642, and/or in U.S. pat. application, Ser. No. 09/199,907, filed Nov. 25, 1998 by Bos et al. for WIDE ANGLE IMAGE CAPTURE SYSTEM FOR VEHICLE, now U.S. Pat. No. 6,717,610 (Attorney Docket DON01 P-676), which are hereby incorporated herein by reference.

Please amend the paragraph beginning at page 15, line 29 as follows:

Lens system 24 is positioned within cylindrical portion 12a of camera portion 12 so as to receive light from the exterior or interior scene through cover 22 at end 12c of camera portion 12.

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Lens system 24 is mounted to, such as via threaded engagement with, camera cover or housing 28, which functions to substantially cover or encase camera or sensor 18 to substantially prevent or limit incident light from being received by camera 18 and interfering with the image received by camera 18 through cover 22 and lens system 24. The lens system 24 may be any small lens or lens system which may focus an image of the scene exteriorly of the camera module onto the camera or image sensor 18, such as, for example, the types disclosed in U.S. Pat. No. 6,201,642; and/or in U.S. pat. application, Ser. No. 10/010,862, filed Dec. 6, 2001 by Bos for PLASTIC LENS SYSTEM FOR VEHICLE IMAGING SYSTEM, now U.S. Pat. No. 6,757,109 (Attorney Docket ~~DON01 P-954~~), which are hereby incorporated herein by reference. The lens system 24 may provide a wide-angle field of view, such as approximately 120 degrees or more.

Please amend the paragraph beginning at page 23, line 31 as follows:

Imaging device 116 may be operable in conjunction with a vision or imaging system of the vehicle, such as a reverse or backup aid system, such as a rearwardly directed vehicle vision system utilizing principles disclosed in U.S. Pat. Nos. 5,550,677; 5,760,962; 5,670,935; 5,760,962; 5,877,897; 5,949,331; 6,222,447; 6,302,545; 6,396,397; 6,498,620; 6,523,964; 6,611,202; and/or 6,201,642, and/or in U.S. pat. applications, Ser. No. 09/199,907, filed Nov. 25, 1998 by Bos et al. for WIDE ANGLE IMAGE CAPTURE SYSTEM FOR VEHICLE, now U.S. Pat. No. 6,717,610 (Attorney Docket ~~DON01 P-676~~); Ser. No. 10/372,873, filed Feb. 24, 2003 by Schofield et al. for VEHICLE IMAGE CAPTURE SYSTEM, now U.S. Pat. No. 6,802,617 (Attorney Docket ~~DON01 P-1077~~); Ser. No. 10/011,517, filed Nov. 5, 2001 by Bos et al. for INTERIOR REARVIEW MIRROR SYSTEM INCLUDING A FORWARD FACING VIDEO DEVICE, now U.S. Pat. No. 6,806,452 (Attorney Docket ~~DON01 P-934~~); Ser. No. 10/324,679, filed Dec. 20, 2002 by Schofield et al. for VEHICULAR VISION SYSTEM, now U.S. Pat. No. 6,891,563 (Attorney Docket ~~DON01 P-1059~~); Ser. No. 10/047,901, filed Jan. 14, 2002 by Bos et al. for VEHICLE IMAGING SYSTEM WITH ACCESSORY CONTROL, now U.S. Pat. No. 6,822,563 (Attorney Docket ~~DON08 P-949~~); and Ser. No. 10/643,602, filed Aug. 19, 2003 by

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Schofield et al. for VISION SYSTEM FOR A VEHICLE INCLUDING IMAGING PROCESSOR (Attorney Docket DON01 P-1087); and Ser. No. 10/010,862, filed Dec. 6, 2001 by Bos for PLASTIC LENS SYSTEM FOR VEHICLE IMAGING SYSTEM, now U.S. Pat. No. 6,757,109 (Attorney Docket ~~DON01 P-954~~), which are hereby incorporated herein by reference, a trailer hitching aid or tow check system, such as the type disclosed in U.S. pat. application, Ser. No. 10/418,486, filed Apr. 18, 2003 by McMahon et al. for VEHICLE IMAGING SYSTEM, now U.S. Pat. No. 7,005,974 (Attorney Docket ~~DON01 P-1070~~), which is hereby incorporated herein by reference, or an imaging system that may utilize aspects of other imaging or vision systems, such as the types disclosed in U.S. pat. applications, Ser. No. 10/054,633, filed Jan. 22, 2002 by Lynam et al. for VEHICULAR LIGHTING SYSTEM, now U.S. Pat. No. 7,195,381 (Attorney Docket ~~DON01 P-962~~); and Ser. No. 09/793,002, filed Feb. 26, 2001, entitled VIDEO MIRROR SYSTEMS INCORPORATING AN ACCESSORY MODULE, now U.S. Pat. No. 6,690,268 (Attorney Docket ~~DON01 P-869~~), which are hereby incorporated herein by reference. The imaging system includes a control or control system or device that is operable to process images captured by the imaging device 116 and a display 115 (FIG. 1) for displaying the captured images to a driver or occupant of the vehicle. The display may be positioned at an interior portion of the vehicle, such as at an interior rearview mirror assembly of the vehicle or accessory module of the vehicle or the like. The display may comprise a video display screen at a mirror assembly, such as the type disclosed in U.S. provisional applications, Ser. No. 60/439,626, filed Jan. 13, 2003 by Hutzel et al. for MIRROR WITH VIDEO DISPLAY SCREEN (Attorney Docket ~~DON01 P-1061~~); Ser. No. 60/489,812, filed Jul. 24, 2003 by Hutzel et al. for ACCESSORY SYSTEM FOR VEHICLE (Attorney Docket ~~DON01 P-1100~~); and Ser. No. 60/492,225, filed Aug. 1, 2003 by Hutzel et al. for ACCESSORY SYSTEM FOR VEHICLE (Attorney Docket ~~DON01 P-1107~~), which are hereby incorporated herein by reference, or may comprise other types of displays or display systems, such as, for example, a display on demand type of display, such as the types disclosed in commonly assigned U.S. Pat. Nos. 5,668,663 and 5,724,187, and U.S. pat. applications, Ser. No. 10/054,633, filed Jan. 22, 2002 by Lynam et al. for VEHICULAR LIGHTING SYSTEM, now U.S. Pat. No. 7,195,381 (Attorney Docket ~~DON01~~

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P-962); and Ser. No. 09/793,002, filed Feb. 26, 2001, entitled VIDEO MIRROR SYSTEMS INCORPORATING AN ACCESSORY MODULE, now U.S. Pat. No. 6,690,268 (Attorney Docket ~~DON01 P-869~~), which are hereby incorporated by reference herein, without affecting the scope of the present invention.

Please amend the paragraph beginning at page 30, line 15 as follows:

Also, by using the folding adjustment of the camera housing device to adjust the position of the camera, the housing device and camera may be adjustable to provide a different view of the area behind the vehicle. The control of the imaging system may then be operable to process images captured in each of the views and may compare the images to determine distances to objects detected in the exterior scene (such as by utilizing principles disclosed in U.S. Pat. No. 6,396,397; and/or in U.S. pat. application, Ser. No. 10/427,051, filed Apr. 30, 2003 by Pawlicki et al. for OBJECT DETECTION SYSTEM FOR VEHICLE, now U.S. Pat. No. 7,038,577 (Attorney Docket ~~DON01 P-1075~~), which are hereby incorporated herein by reference). By electronic comparison of the images captured between two positions of the camera (capturing at least one image in each of the two views), a distance map can be produced. Such a distance map may then be used to provide additional information about the exterior scene to the driver of the vehicle.

Please amend the paragraph beginning at page 33, line 14 as follows:

Image capture system 310 may be positioned at the exterior portion of the vehicle and directed generally exteriorly of the vehicle for capturing images of the exterior scene to assist the driver in maneuvering or driving the vehicle. Image capture system 310 may utilize principles of other vehicle vision or imaging systems, such as a forwardly, sidewardly or rearwardly directed vehicle vision system or imaging system or the like utilizing principles of the systems disclosed in U.S. Pat. Nos. 5,550,677; 5,670,935; 5,760,962; 5,796,094; 5,877,897; 5,949,331; 6,097,023;

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6,201,642; 6,222,447; 6,302,545; 6,313,454; 6,320,176; 6,353,392; 6,396,397; 6,498,620; 6,523,964; 6,559,435; and 6,611,202, and U.S. pat. applications, Ser. No. 09/441,341, filed Nov. 16, 1999 by Schofield et al. for VEHICLE HEADLIGHT CONTROL USING IMAGING SENSOR, now U.S. Pat. No. 7,339,149 (Attorney Docket ~~DON01 P-770~~); Ser. No. 10/427,146, filed Apr. 30, 2003 by Schofield et al. for VEHICLE HEADLIGHT CONTROL USING IMAGING SENSOR, now U.S. Pat. No. 6,831,261 (Attorney Docket ~~DON01 P-1091~~); Ser. No. 09/199,907, filed Nov. 25, 1998 by Bos et al. for WIDE ANGLE IMAGE CAPTURE SYSTEM FOR VEHICLE, now U.S. Pat. No. 6,717,610 (Attorney Docket ~~DON01 P-676~~); Ser. No. 10/372,873, filed Feb. 24, 2003 by Schofield et al. for VEHICLE IMAGE CAPTURE SYSTEM, now U.S. Pat. No. 6,802,617 (Attorney Docket ~~DON01 P-1077~~); Ser. No. 10/011,517, filed Nov. 5, 2001 by Bos et al. for INTERIOR REARVIEW MIRROR SYSTEM INCLUDING A FORWARD FACING VIDEO DEVICE, now U.S. Pat. No. 6,806,452 (Attorney Docket ~~DON01 P-934~~); Ser. No. 10/324,679, filed Dec. 20, 2002 by Schofield et al. for VEHICULAR VISION SYSTEM, now U.S. Pat. No. 6,891,563 (Attorney Docket ~~DON01 P-1059~~); Ser. No. 10/047,901, filed Jan. 14, 2002 by Bos et al. for VEHICLE IMAGING SYSTEM WITH ACCESSORY CONTROL, now U.S. Pat. No. 6,822,563 (Attorney Docket ~~DON08 P-949~~); Ser. No. 10/643,602, filed Aug. 19, 2003 by Schofield et al. for VISION SYSTEM FOR A VEHICLE INCLUDING IMAGE PROCESSOR (Attorney Docket DON01 P-1087); and Ser. No. 10/010,862, filed Dec. 6, 2001 by Bos for PLASTIC LENS SYSTEM FOR VEHICLE IMAGING SYSTEM, now U.S. Pat. No. 6,757,109 (Attorney Docket ~~DON01 P-954~~), which are hereby incorporated herein by reference. The imaging system may be operable to captures images of the scene immediately rearward of the vehicle to assist the driver of the vehicle in backing up or maneuvering the vehicle in reverse. The back up assist system may be operable in response to the reverse gear of the vehicle being selected.

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Please amend the paragraph beginning at page 34, line 9 as follows:

Image capture device or camera or imaging sensor 316 may comprise an imaging array sensor or a pixelated imaging array, such as a multi-pixel array such as a CMOS sensor or a CCD sensor or the like, such as the types disclosed in commonly assigned U.S. Pat. Nos. 5,550,677; 5,670,935; 5,796,094; 6,097,023; and 6,498,620, and U.S. pat. applications, Ser. No. 09/441,341, filed Nov. 16, 1999 by Schofield et al. for VEHICLE HEADLIGHT CONTROL USING IMAGING SENSOR, now U.S. Pat. No. 7,339,149 (Attorney Docket ~~DON01 P-770~~); and Ser. No. 09/793,002, filed Feb. 26, 2001 by Schofield et al. for VIDEO MIRROR SYSTEMS INCORPORATING AN ACCESSORY MODULE, now U.S. Pat. No. 6,690,268 (Attorney Docket ~~DON01 P-869~~), which are hereby incorporated herein by reference, or such as an extended dynamic range camera, such as the types described above. For example, the imaging sensor may comprise a CMOS camera, such as the OV7930 single chip CMOS color NTSC camera available from OmniVision Technologies Inc. of Sunnyvale, CA. Such color cameras may have the performance characteristics identified above and may additionally provide RGB and/or YCrCb video signals. Preferably, the color video camera operates at a minimum illumination (3000 K) of less than about 5 lux at f1.2, more preferably of less than about 3 lux at f1.2, and most preferably less than about of less than about 2 lux at f1.2. Such CMOS imaging sensors typically may have a peak sensitivity in the near infrared range, such as at approximately 850 nm to 900 nm.

Please amend the paragraph beginning at page 37, line 3 as follows:

The imaging sensor 316 may receive or capture images via imaging lens 324 and a bandpass filter 328, all of which may be positioned behind the transparent window of camera module 322. The images captured by imaging sensor 316 may be received by an image processor 330 and data translator 332, which may process the images or pixel outputs as desired. For example, the image processor 330 and data translator 332 may be operable to process the images

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to determine if an object is present in the detected image, such as by utilizing the principles disclosed in U.S. pat. application, Ser. No. 10/427,051, filed Apr. 30, 2003, now U.S. Pat. No. 7,038,577 (~~Attorney Docket DON01 P 1075~~), which is hereby incorporated herein by reference, or may process the captured images to extract other information therefrom, without affecting the scope of the present invention. The data translator 332 may also receive inputs 333 pertaining to vehicle data or vehicle status data or the like. The images captured may be displayed at the display or display system 314, and/or the processed images or information derived or extracted from the processed images may be displayed at the display or display system 314.

Please amend the paragraph beginning at page 37, line 29 as follows:

As disclosed in U.S. Pat. Nos. 5,550,677; 5,670,935; 5,796,094; 6,097,023; and 6,498,620, and U.S. pat. applications, Ser. No. 09/441,341, filed Nov. 16, 1999 by Schofield et al. for VEHICLE HEADLIGHT CONTROL USING IMAGING SENSOR, now U.S. Pat. No. 7,339,149 (~~Attorney Docket DON01 P 770~~); and Ser. No. 09/793,002, filed Feb. 26, 2001 by Schofield et al. for VIDEO MIRROR SYSTEMS INCORPORATING AN ACCESSORY MODULE, now U.S. Pat. No. 6,690,268 (~~Attorney Docket DON01 P 869~~), which are hereby incorporated herein by reference, the pixels of the imaging array sensor 316 may be individually operable to measure a particular color or range of color (such as red, green and blue) in the visible spectrum to determine the color image. Any near infrared radiation or infrared radiation that is received by the pixels may add to the measured value of the particular color that the particular pixel senses or accumulates. This results in a shift in the representation in the color of the captured image and may result in an image having unsatisfactory or unrepresentative color. Optionally, and as discussed below, the band pass filter 328 of the imaging system may comprise an infrared or near infrared filter, which may filter out or substantially block light in the infrared and/or near infrared range of the spectrum, such as light having wavelengths in the approximately 750 to 900 nm, and preferably blocking or reducing transmission of some light in the visible region of the electromagnetic spectrum so that band pass filter 328 passes (i.e. is highly

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transmitting to) visible wavelengths up to about 650 nm or thereabouts, but has reduced transmission above about 650 nm and, in particular, has substantially reduced transmission in the near infrared region.

Please amend the paragraph beginning at page 43, line 13 as follows:

Optionally, it is further envisioned that the imaging system may function to remove the infrared filter from in front of the imaging sensor when the infrared illumination sources are activated, such as described in U.S. pat. application, Ser. No. 09/793,002, filed Feb. 26, 2001 by Schofield et al. for VIDEO MIRROR SYSTEMS INCORPORATING AN ACCESSORY MODULE, now U.S. Pat. No. 6,690,268 (Attorney Doeket DON01 P 869), which is hereby incorporated herein by reference. For example, at nighttime when ambient lighting is low and the infrared emitting illumination sources are activated, the infrared filter element may be moved out of the field of view of the lens so that the detector or camera can view unattenuated infrared radiation from the infrared emitting illumination sources so that the output image in the video display is discernable by the driver. Various means can be used to remove the infrared filter element from the camera field of view during nighttime. For example, an electromechanical mechanism, preferably operated by the microcontroller in response to a photo sensor or ambient light sensor, can automatically move the infrared filter element, such as by electrical command, out of the line of sight or field of view of the imaging sensor when the ambient lighting conditions are low.

Please amend the paragraph beginning at page 43, line 28 as follows:

Optionally, electro-optic means can be used to prevent color wash out by day while maximizing low light sensitivity by night. For example, an electrochromic infrared filter can be used, such as a filter utilizing the principles disclosed in U.S. Pat. No. 6,426,492, and U.S. pat. application, Ser. No. 10/206,558, filed Jul. 26, 2002 by Bos for ELECTRO-OPTIC FILTER FOR

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VEHICLE IMAGING SYSTEM, now U.S. Pat. No. 6,667,471 (Attorney Docket DON01-P-1013), which are hereby incorporated herein by reference. The filter may include a tungsten oxide electrochromic layer that changes from being substantially visible light transmitting and substantially near-infrared transmitting when uncharged (bleached) and transforms to being significantly near-infrared absorbing/reflecting as well as being significantly visible light attenuating when cathodically charged. The degree of near-infrared attenuation and visible light attenuation is proportional to the negative voltage applied to the electrochromic tungsten oxide metal oxide layer, with applied voltages in the 0.1V to about 2.5V range typical. The higher the cathodic voltage applied, the more the near-infrared/visible light attenuation.